# EMBRYO DEVELOPMENT OF THE POND CYPRESS (*TAXODIUM ASCENDENS BRONGN.*)*

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Collections of material for this study were made in Collier County, Florida, along the Tamiami Trail (U. S. Highway 94) in August of 1947 and May of 1948. Since it has been stated (Davis, 1943) that the pond cypress, *Taxodium ascendens* Brongn., growing in this region could possibly be a variety of the bald cypress, *T. distichum* (L.) Rich., care was used in the examination of all trees sampled. Rehder (1947) makes use of the differences in the leaf shape and arrangement and habit of growth of the branchlets in separating these two plants in his manual and recognizes *T. ascendens* as a valid species. Certainly the subulate leaves, incurved and closely appressed to the twigs, and the more upright growth of the branchlets of the pond cypress are all characteristics in marked contrast to the linear, spreading, two-ranked leaves and the more horizontal growth of branchlets of the bald cypress (Plate I).

The May 1948 collections were used for study of proembryo and early embryo stages, and the August 1947 collections provided material for matured seed and cotyledon counts. Megagametophytes containing proembryo stages were killed and fixed in F.A.A., sectioned ten microns in thickness and stained with Haidenhain's haemotoxylin and Orange G. Embryos in later stages were dissected and prepared according to the method used by Buchholz (1936). Terminology follows that of Buchholz (1946). The embryo pattern of development closely parallels that of *T. distichum* (Kaeiser, 1940).

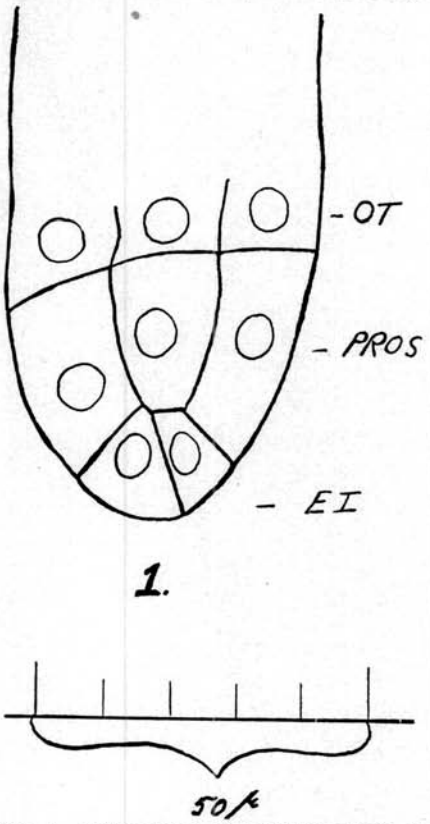


FIG. 1.—Proembryo of Pond Cypress, *T. ascendens*. OT, open tier of cells; PROS, prosuspensor; EI, embryo initials.

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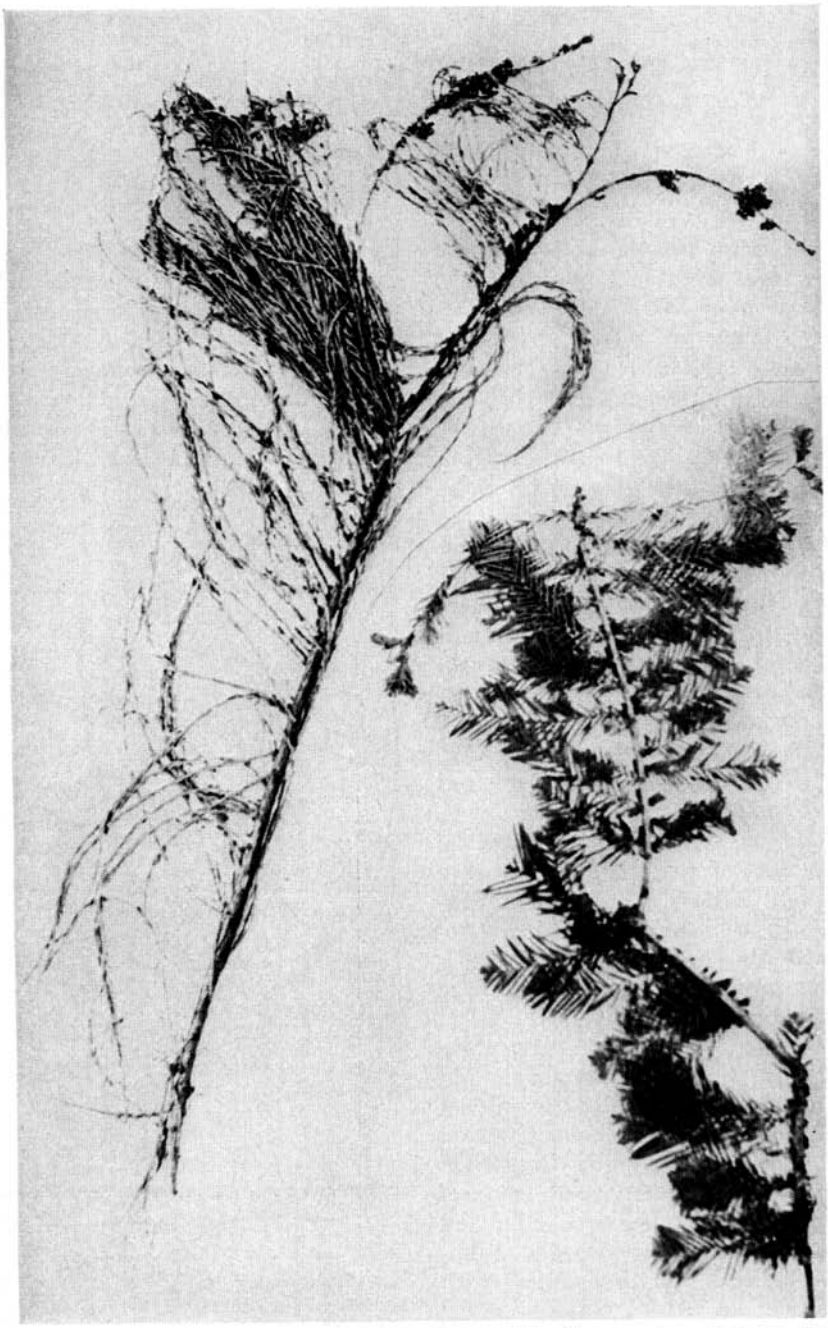

PLATE I.—Left, Leaf and branchlet arrangement in *T. ascendens* Brongn. Right, Leaf and branchlet arrangement in *Taxodium distichum* (L.) Rich.

Proembryos were obtained of the stage shown in Figure 1. There is no rosette tier. The open tier (OT) has six cells. The prosuspensor tier (PROS) consists of six cells. At the bottom of the archegonium four embryo initials (EI) are present. The proembryo at this stage occupies approximately the lower one-third of the archegonium. The embryo initials are frequently arranged in tetrahedral fashion (Figs. 2, 2a, 2b). This organization is similar to that found in *T. distichum*. There is no primary suspensor system.

Of almost one hundred archegonial complexes examined which showed any subsequent development of embryos, the number of embryo systems of which each was developed from one proembryo ranged from one to four per archegonial complex. Most dissections revealed two or three separate embryo systems per archegonial complex. These resulted from separate fertilizations and are indicative of simple polyembryony.

The prosuspensor cells elongate and push through the lower portion of the archegonium. Some elongation is already apparent in Figure 1. They are often much coiled and twisted. Occasionally one or more may appear separated from the embryo initials (Fig. 2a). No other cell or cells appear to arise from these isolated prosuspensor cells.

The open tiers of nuclei, incompletely separated by walls, are transitory. Their nuclei had disintegrated in the later stages studied.

Figure 3 shows early divisions of the four embryo initials (EI) of one embryo system. Each unit is to be regarded as a separate embryo. This is an early indication of cleavage polyembryony.

Later stages in development of individual embryos appeared as shown in Figures 4-6. Figures 4 and 5 show the formation of embryonal tubes (ET). The embryonal tubes, formed by divisions of the embryo initials, form a secondary suspensor system.

Even in comparatively early stages of development of embryos from one embryo system, one of the embryos is usually larger in size, as shown in Figure 6. This figure shows only approximately one-third of the extensive prosuspensor.

In only one case of dissection of matured seeds was there found more than one embryo. (This would be indicative of simple polyembryony were it not for cleavage polyembryony which becomes manifest very soon.) In this case there was great discrepancy in size of the two embryos present within the megagametophyte and both appeared to be attached to the same prosuspensor system. In archegonial complexes examined that contained the sixteen-celled proembryos within the archegonia, it was noted that elongation of some of the prosuspensors was more advanced in some embryo systems than in others within the same complex. Embryo initials of some more advanced systems were also found to be more deeply imbedded in the gametophyte than were their neighbors from adjacent archegonia because of the greater elongation of their prosuspensors. These observations would suggest that the early rapid growth (elongation) of the prosuspensor cells of any one embryo system, as well as the earlier pre-

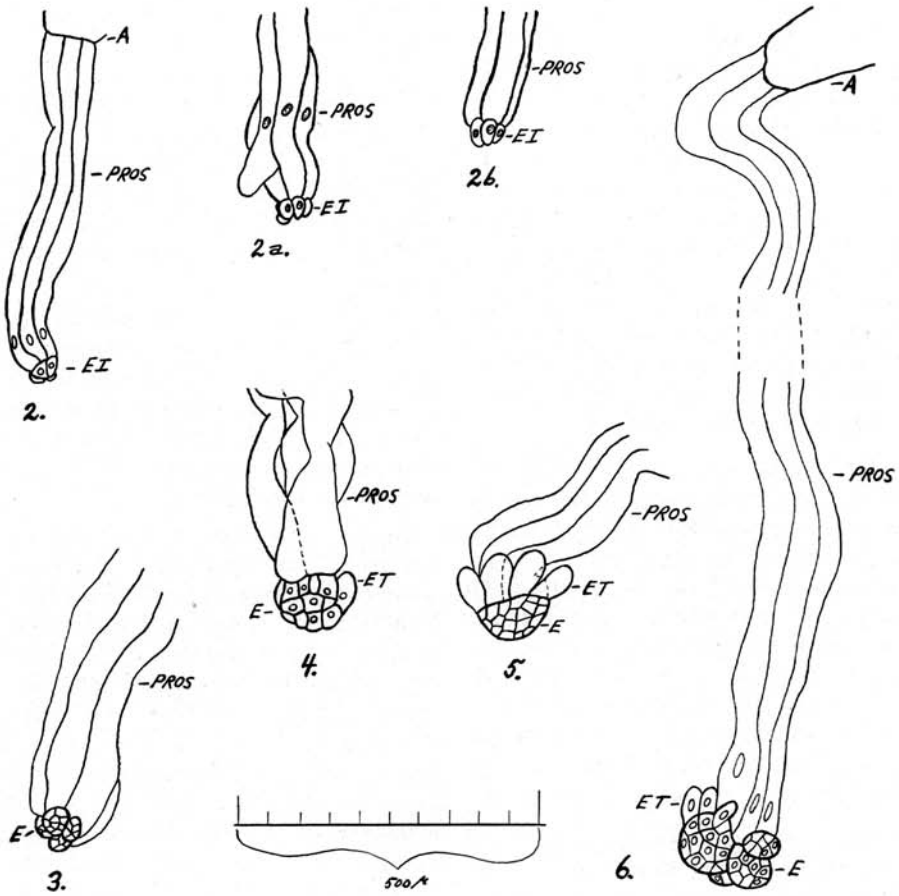


Fig. 2.—One embryo system showing elongated prosuspensor. A, archegonium; PROS, prosuspensor; EI, four embryo initials.

Fig. 2a.—Lower portion of one embryo system showing one of four prosuspensor (PROS) cells detached from embryo initials (EI).

Fig. 2b.—Lower portion of one embryo system showing three of four prosuspensor (PROS) cells and characteristic tetrahedral arrangement of embryo initial cells (EI).

Fig. 3.—Lower portion of one embyro system showing four prosuspensor cells (PROS) and four individual embryos (E). Early indication of cleavage polyembryony.

Fig. 4.—Later stage of embryo development (E) showing one embryonal tube (ET) of secondary suspensor system. PROS, prosuspensor.

Fig. 5.—Similar to Fig. 4, with additional embryonal tubes. PROS, prosuspensor; ET, embryonal tubes; E, embryo.

Fig. 6.—Approximately one-third of elongated prosuspensor shown. Note larger size of one embryo showing early stage in development of secondary suspensor system (ET). A, archegonium; PROS, prosuspensor; ET, one of several embryonal tubes attached to largest embryo; E, one of four embryos.

dominance in size of one of its embryos, are among the critical factors in determining which embryo shall ultimately survive.

The matured embryo closely resembles that of *T. distichum*.

Of five hundred seeds of *T. ascendens* selected at random from cones collected in August 1948, only 8.4 percent contained embryos. Of these matured embryos examined the number of cotyledons per embryo varied from five to seven with 69.04 percent showing six. Similar counts made of *T. distichum* (Kaeiser, 1940) from Arkansas yielded 16.6 percent good seeds, although 45 percent has been reported by R. M. Fisher of the Thompson Tree Nursery of Jonesboro, Illinois, for crops previous to 1939 in southern Illinois.* The cotyledon counts made by the author on three hundred *T. distichum* seedlings showed a range of four to eight with the majority showing six. The low percentage of pond cypress seeds with embryos might possibly be explained on an environmental basis. In the regions where collections were made the plants are referred to as "scrub cypress" and are of generally smaller growth than *T. distichum* (Davis, 1943).

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